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ABSTRACT

A study investigated how students' mental representation of an expository text and the inferences they used in summarizing varied as a function of text difficulty and of differences in the task. Subjects, 96 college students and students from grades 6 and 10, wrote summaries of expository texts and answered orally several probe questions about the content. Reading difficulty was systematically manipulated at the microstructure and macrostructure processing levels. Results supported the prediction of qualitative changes in the way the meaning is represented by different age groups in different text conditions which are related to the amount and kinds of inferential processes on which the summaries were based. Results also indicated that although college students generalized the content more in summarizing texts with poor macrostructure, these same texts interfered with the sixth graders' ability to infer or select text-based macropropositions. (Seven figures of data are included; and 47 references and examples of expository text are appended.) (RS)

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Macroprocesses and Microprocesses in the Development of Summarization Skill

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ICS Technical Report #89-5

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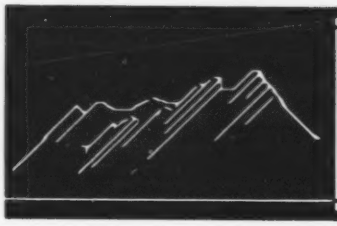

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Running head: MACROPROCESSES AND MICROPROCESSES

Abstract

The present study explored how students' mental representation of an expository text and the inferences they use in summarizing varies as a function of text difficulty and of differences in the task. Ninety-six students from Grades 6, 10, and College were asked to write summaries of expository texts and then to answer orally several probe questions about the content. Reading difficulty was systematically manipulated at the microstructure and macrostructure processing levels. The results supported the prediction of qualitative changes in the way the meaning is represented by different age groups in different text conditions. These are related to the amount and kinds of inferential processes on which the summaries were based. Interestingly, college students generalized the content more in summarizing texts with poor macrostructure than those that were well organized. The fact that more macropropositional statements occurred in responding to the probe questions than in the summaries could be explained in terms of the different memory conditions that prevailed. Some educational implications of these findings are discussed.

Macroprocesses and Microprocesses in the Development of Summarization Skill

Current views of reading comprehension assume an active process of meaning construction in which the reader derives a personal interpretation of the textual content. This interpretation includes of a mental representation of the gist of the author's message. Thus, memory for the essential information is what is typically retained by an experienced, adult reader, especially following delay or if the passage is quite long.

This memory representation is the result of various inferential operations which select certain kinds of information as important and subsume details into more generalized statements. The van Dijk and W. Kintsch (1983) model of discourse comprehension, assumes that the reader constructs the generalized meaning, or *macrostructure*, on line during reading, forming hypotheses about main points, or *macropropositions*, as soon as there is enough information to hazard a guess. Subsequent research has supported this assumption, at least for adult readers with normal skills who are reading materials that are not excessively difficult (e.g., Guindon & W. Kintsch, 1984; Lorch, Lorch, & Mathews, 1985; Mross, 1988).

However, like other aspects of reading skill, efficient macroprocessing strategies are the product of experience in dealing with textual materials of various types. Not surprisingly, a number of recent studies have provided evidence that school children, and even more advanced students, are not efficient

macroprocessors. In fact, research on the role of higher-level comprehension processes in reading suggests quite strongly that these processes may form another stumbling block to the development of expert skill (e.g., Bereiter, 1985; Brown, Bransford, Ferrara, & Campione, 1983; Perfetti, 1985).

Across a number of studies of children's text processing strategies a pattern has emerged that looks quite different from the gist-oriented strategies described in van Dijk and W. Kintsch, 1983 and W. Kintsch and van Dijk (1978). Summaries that are largely generated by selection and deletion operations (e.g., Brown & Day, 1983; Winograd, 1984), failure to detect contradictions in meaning during reading (e.g., Markman, 1979; Scardamalia & Bereiter, 1984), associative writing that skips from topic to topic without an overall plan to guide it (e.g., McCutchen & Perfetti, 1982; Scardamalia & Paris, 1985), and incomplete recall protocols that ignore the hierarchical organization of text (e.g., Meyer, Brandt, & Bluth, 1980; Taylor & Samuels, 1983) are characteristic of immature readers and writers and those with inferior skills. Such findings, and others on a variety of school-related tasks, are apparently symptomatic of a general tendency among school-age students to process text in a linear, element-by-element fashion (e.g., Brown, Bransford, Ferrara, & Campione, 1983; Scardamalia & Bereiter, 1984). At least when dealing with expository prose materials, whose structures and content are relatively unfamiliar, such readers appear to concentrate most of their processing efforts on the meaning of individual sentences or sentence pairs, rather than the global meaning (cf. also Englert,

Stewart, & Hiebert, 1983; Di Vesta, Hayward, & Orlando, 1979; Taylor & Samuels, 1983).

Scardamalia and Bereiter (1984) have noted the resemblance of this text processing strategy to microstructure processing in the theoretical model of W. Kintsch and van Dijk (1978; van Dijk & W. Kintsch, 1983). Discourse comprehension, according to that theory, consists of a hierarchy of strategic processes which operate on successively more complex units of the text. The outcome of each strategic operation is a mental representation in memory. Thus, local-level *microprocesses* operate on surface features of the text, deriving the meaning from graphemes, words, syntactic patterns, and organizing it into a list of propositions. Middle-level *coherence processes* are gap-filling inferences that complete the meaning of the propositional microstructure, for example, by connecting pronouns to their referents, establishing the identity of coreferents, and filling in unstated relationships within and between propositions. *Macroprocesses* are higher-order processes that operate on the filled-in microstructure, forming a generalized representation of the meaning at different levels of importance. Other inferential processes may further elaborate the content and serve to integrate it into the reader's own knowledge background. Successful reading comprehension thus results in a hierarchical network of macropropositions that represents the way the content has been interpreted by a particular reader in a particular context.

Although processing at the microstructure level and at the macrostructure level occurs in parallel in skilled reading, there

are situations, for example when attempting to understand very difficult or degenerate text, where adults also resort to largely surface level processing of the meaning (e.g., Hidi, 1984; Eigler & Nenninger, 1985; W. Kintsch & Yarbrough, 1982; Schnotz, Ballstaedt, and Mandl, 1984). These data support the theoretical notion that successful macroprocessing depends on adequate local level coherence. That is, the relationships between individual meaning units apparently need to be worked out before more general relationships can be perceived. Although a skilled reader can do both when the text poses few comprehension problems, a separation between the two levels of processing may occur when microprocesses require too much conscious attention.

The studies of adults' processing of difficult prose thus shed light on the developmental observations discussed above. Perhaps younger students' element-by-element processing of expository text has to do with the fact that their ability to construct a coherent meaning representation is not yet fully automatic. Even though decoding skills have usually been mastered by the middle elementary years, coherence processes may still require conscious attention. Hence, limitations in the amount of available processing resources may interfere with the ability to generate meaning-construction inferences (Perfetti, 1985). Yet in addition there may be cognitive limitations on children's ability to form generalizations (e.g., Fischer, 1980; Ohlhausen & Roller, 1988).

In the present study the theoretical description of the comprehension process offered by van Dijk and W. Kintsch (1983) is used to characterize more fully the developmental differences in

text processing strategies that have been observed. In particular, the study focuses on the crucial role of inferences in reading comprehension and on the relationship between strategic processes and the resulting representation of the text in memory.

A summarization task was chosen here to assess the underlying comprehension processes. Summarization, like recall, depends on the meaning representation of a text that is constructed during reading. However, summarization goes beyond recall in its demand to give explicit and coherent verbal expression to that conceptual representation. More conscious attention is directed to selecting the appropriate information to include, and, ideally, a greater effort is made to generalize the information in order to make a concise summary.

Summaries of an expository text written by students of three age groups are examined here from two perspectives: The first is a fine-grained analysis of the propositional and inferential content; the second analysis examines text-based statements in both summaries and probe question responses in terms of their role in the hierarchy of macropropositions. The inference analysis provides a gauge of the constructive processing the material has undergone. The macrostructure analysis focusses on the mental representation of the text on which the summaries are based. Together, the two analyses are intended to reveal to what extent the meaning has been grasped at a macrolevel and to what extent a summary is the product of local-level comprehension processes. Scardamalia and Bereiter (1984) and Bereiter & Scardamalia (1987) have hypothesized that the linear processing strategy of younger,

less skilled readers would result in a much shallower representation of the meaning than the multi-layered macrostructure of an expert. By examining both the inferred material and the structural properties of the summaries, perhaps the relationship between level of processing and the resulting meaning representation can be clarified.

In addition to tracing the growth of macroprocessing ability with age, this study explores how students' mental representation of the text and the inferences they use in summarizing varies as a function of text difficulty. Comprehension ease has been systematically altered by manipulating the difficulty of the texts at the microstructure and the macrostructure level in order to gain a more detailed picture of the range of skills within each age group.

Finally, further evidence for the kinds of processes and mental representations of text inferred from the summaries was sought by analyzing the students' performance on another, related task: their responses to a series of oral probe questions about the material. Of interest here is to see whether the patterns of responses on a cued recall task are similarly related to differences in the quality of the input text as well as to age group.

Method

Subjects

A total of 96 subjects participated in this study, 32 each from Grade 6, Grade 10 and college. The latter group were students from the University of Colorado whose participation partially fulfilled requirements for an introductory psychology course. The

school-age subjects were recruited from Boulder and Denver schools and were paid for their participation, either directly or in the form of a contribution to their schools.

Of the 6th grade subjects 17 were female and 15 male (mean age 11.6 years at time of testing). The high school and college groups both consisted of 20 female and 12 male students (mean age 15.6 and 18.9 years, respectively). All subjects were native speakers of English whose reading skills at each grade level generally reflected a high average within a normal range of abilities. Scores on national standardized tests (Iowa Test of Basic Skills, California Achievement, Scholastic Aptitude Test, and American College Testing) or the passage comprehension subtest of the Woodcock Reading Mastery Tests (1973) was used to screen out subjects with substantial reading deficits.

Materials

Two passages of expository text were developed, each consisting of seven paragraphs (about 465 words). Both texts had the same underlying organization - a compare-contrast rhetorical structure - but they differed in content. Each text compared two developing countries in terms of their future potential. This topic information was stated in the initial paragraph and at the conclusion of all versions of the texts.

There were four versions of each text. The basic version (Good Macro/Good Micro) used a tightly organized structure in which two countries were compared on the basis of three attributes: Geography, Economy, and Society or Culture. One text discussed Peru and Argentina, the other compared Indonesia and

South Korea. The texts were written at an appropriate reading level for 6th grade students. This was determined informally on the basis of teacher evaluations and the 2% - 3% error rates of four average 6th grade readers who read the passage aloud.

The second version of the texts had a difficult macrostructure (Poor Macro/Good Micro), which was achieved by shifting from topic to topic instead of discussing various facts about each attribute in order. For example, a paragraph describing Indonesian agriculture, social problems, and trade was followed by a paragraph containing facts about Korean education, farming, and climate. Although the topic structure was disrupted in this way, local coherence relations were preserved. The version with a poor microstructure (Good Macro/Poor Micro) had more difficult and longer words, longer and more complex sentence patterns, and few explicit connectives signalling the relationships between sentences or phrases or between larger segments of text. Finally, the fourth version had both the macrostructure and the microstructure disrupted as described above (Poor Macro/Poor Micro).

An important feature of the texts was the fact the three attributes, or major subtopics, were never explicitly mentioned and had to be inferred by the reader. (Though the scoring here is based on inferences, this would correspond to *topic invention* in Brown and Day's, 1983, list of macrorules.) In addition, the content as a whole was stated at a very concrete level in order to maximize the opportunity for generalized statements in summarizing and in responding to the probe questions. Since the global topic was explicitly stated at the beginning and conclusion of each

text, restatements or paraphrases of this information could be expected. (This would correspond to *topic selection* in Brown and Day.)

Although differences in general knowledge undoubtedly existed across this range of ages, this could not be controlled nor assessed in a detailed manner in the present design. Instead, a neutral content domain was chosen, based on the assumption that most subjects, including the older ones, have only rather vague knowledge about these foreign countries.

In sum, the experimental manipulations consisted of systematically interfering with comprehension processes at the microprocessing level and/or at the macroprocessing level in order to learn more about the skills that students of different ages bring to the summarization task: At what level are their processing efforts primarily directed under different text and task conditions? To what extent are they able to repair the problems exhibited by a particular text in their summaries? Examples of the materials are available in Appendix A.

Procedure

The subjects were individually tested in a single session lasting 30 - 50 minutes. Each subject was given one of the versions of either the Indonesia/Korea or the Peru/Argentina text to read and summarize in writing, with the conditions counterbalanced within each age group.

Brief oral instructions informed the subject about the nature of the task and provided a definition of the term *summary*. Subjects were asked to read the passage at least two times and were

allowed to underline the text, take notes, or make a rough draft, if desired. Neither time limit nor length constraints were imposed, and the text was available to refer to during writing. After finishing the summary, subjects filled out a brief questionnaire about their knowledge of the countries discussed in the text.

A set of four probe questions was then administered orally, and the responses were tape recorded for later transcription and analysis. The questions were designed to assess first in general terms a subject's understanding of the overall topic, and then more specifically what he or she considered to be the main ideas. The first question - "What is this text mainly about?" - could be answered by selecting one or more of the topic sentences that occurred in the text. The other questions probed for ideas, not all of which were stated in the text, especially the three implicit subtopics (Geography, Economy and Society/Culture).

Scoring

The summaries were analyzed in two ways. The first analysis was concerned with the number of actual text propositions vs. the inferred propositions in the summaries. This analysis provided an estimate of the meaning construction processes. The second analysis compared the importance level of the text-based information to the author's organization of the content to see to what extent the intended macrostructure was represented. Text was not a separate factor in either analysis; instead the results were collapsed across the two texts.

Text Propositions and Inferences. The summaries were first scored for the number of text propositions they contained. Using the propositional analysis program developed by Turner (1987), each input text was decomposed into a list of propositions which served as a template for scoring the textual information in the summaries. A liberal, gist scoring criterion was employed (Turner & Greene, 1978). The nontext statements were then propositionalized and assigned to inference categories.

Inferences form a continuum in terms of their closeness to the actual text, as opposed to being extrapolations from the reader's own knowledge. However, several categories of inferences can be defined according to the role they play in the comprehension process. The following operational definitions are based on van Dijk and W. Kintsch (1983).

(1) Generalizations are reductive inferences constructed from more detailed statements in the text. They can be traced to the actual propositions they subsume, except for global generalizations, which are inferences about the overall meaning of the text. Generalizations reduce the number of text propositions by at least one, though often by many more. For example, several concrete statements about farming in Indonesia were often generalized as *Indonesians use primitive farming methods.*

(2) Elaborations are inferences that are not directly implied by the text. Instead they originate from the subject's own knowledge about the content of the text or related information. For example, *Minerals are important to a country's economy* cannot be traced to propositions in the Peru/Argentina text.

The other two inference categories were scored independently of the elaborations and generalizations.

(3) Reorderings are inferences that re-arrange text content in a different order than it occurred in the original text. Only between-paragraph, i.e., macro-level, reorderings were considered here. These were not scored at the propositional level; instead a sentence or phrase was counted as a reordering if it required backtracking to an earlier paragraph to find its counterpart in the original text.

(4) Connectives are a type of bridging inference whose function is to provide coherence between the thoughts and ideas being expressed. There is much variability in the degree to which a writer or speaker makes these relationships explicit, but some inferential work is always left up to the comprehender. The number of explicit syntactic connectives between clauses, sentences, or paragraphs served as a measure of coherence processes. These were words or phrases, usually expressing a coordinating, causal, contrastive, or temporal relationship. A list of connectives, based on the linguistic description in van Dijk and Petöfi (1977), was used to guide scoring. The word *and* was not included in the analysis because it denotes a weak coordinating relationship and tends to be used as a filler or place keeper, especially by children.

To sum up, generalizations, reorderings, and elaborations are expected to play a particulary important role in summarizing the texts with poor macrostructure. Introduction of connectives, which are an index of coherence building processes, should be most

evident in the summaries of poor microstructure texts from which they had been deleted.

Level in the Macrostructure. A macrostructure consists not only of generalizations of textual details, but also of propositions selected from the text on the basis of their importance to the overall meaning. Such propositions also function as macropropositions. Therefore it is important to examine not only the amount of generalized information in a summary, but also to see if the information included is macrorelevant. To what extent a summary or probe question response contains the important information from the text can be assessed by comparing it with the macrostructure that the author had in mind while writing the text. Thus in scoring both summaries and probe question responses, the level of importance was determined for each text-based statement by comparing it with this intended macrostructure.

The author's intended macrostructure for both the Indonesia/Korea and the Argentina/Peru texts consists of three levels of macropropositions and one level of details. The macrostructure of the latter text is provided in Apppendix B. The levels were scored as follows, with the number of possible statements at each level shown in brackets:

Level 1 (3 statements) consists of topic statements, either a label (*It's about Peru and Argentina*) or a more elaborated topic statement (e.g., that the two countries are compared, that there are factors that influence their development). This information could be found in the first and last paragraphs.

Level 2 (3 statements) are the inferred subtopics, the three factors - Geography, Economy, Society - on which the countries are being compared. A statement at this level had to involve a comparison of the two countries.

Level 3 (15 statements) are other text-based macropropositions (e.g., government, education, industry, agriculture) that function as subheadings for groups of detailed statements. Some are inferred, others are mentioned in the text. These statements could refer to one country, or the two countries could be compared. For the latter credit was given for two macropropositions.

Level 4 (38 statements) consists of a representative, though not comprehensive list of concrete details from the text.

The summaries and responses to the probe questions were scored in the same fashion by matching the text-based statements they contained to counterparts at these four levels. Although the oral responses included many elaborations and sometimes spurious statements, only text-based statements could be reliably assigned to a particular level. The score for both the summaries and the questions is based on the percentage of the total possible at each level.

The scoring was performed by the author. The list of text propositions for each text version was used as the basis for propositional scoring. A checklist was used to score the presence of connectives in the summaries, and reorderings were checked against the order of statements in the original text. Scoring the other inference categories - generalizations vs. elaborations - and assigning statements to macrostructure levels involves more

subjective judgments. Therefore reliability in scoring these measures was assessed on 12% of the summaries by an independent rater who was blind to the experimental manipulations. The two raters agreed 84% and 88% of the time on the inference categories and the macrostructure levels, respectively. In both cases, most of the disputes were omissions or could be resolved in discussion.

Results

The effects of three independent variables, Age Group, Macrostructure, and Microstructure of the input text, were investigated in order to assess the strategic processes and mental representations underlying summaries and probe question responses. The results of the proposition and inference analysis are presented first, followed by the results of the macrostructure level analysis. A significance level of $p < .05$ was adopted for all analyses.

Text Propositions and Inferences in the Summaries

A 3 (Age Group) x 2 (Macrostructure) x 2 (Microstructure) analysis of variance was used to analyze the number of text propositions, generalizations, elaborations, and reorderings and percent connectives in the summaries. In addition, a Newman-Keuhls post hoc analysis was performed where significant main effects and interactions had been observed in order to specify the locus of the effect.

Text Propositions. There were no significant differences in the number of text propositions generated by the three age groups. Nor were any of the interactions of age by text condition significant. This is not surprising since subjects had access to the

text while writing and hence their selection of textual information was not affected by memory constraints. The interesting differences are better described by the following measures.

Generalizations. Significant differences between the three age groups were obtained on this measure : $F(2,84) = 30.44$ MSe = 3644.89. The group means depicted in Figure 1 show a gradual increase in number of generalizations across the three age groups. The 6th graders gave significantly fewer generalizations in both Good and Poor Macro conditions than the other two age groups according to post hoc analysis. This figure also reveals a significant interaction between Group and Macrostructure, $F(2,84) = 3.50$, MSe = 418.95. Whereas the 6th graders produced somewhat fewer generalizations for texts with poor macrostructure than those with good macrostructure, the numbers were about the same for 10th graders. In contrast, the college students actually produced more generalizations in summarizing the Poor Macrostructure texts. The means for this age group were significantly different on post hoc testing. It appears that the older students were trying to compensate for the poorly structured input by generalizing the information.

See Figure 1

Elaborations. There was a significant increase in the use of elaborations with age: $F(2,84) = 6.61$, MSe = 283.53. In addition, a significant three-way interaction of Group x Macrostructure x Microstructure was observed, $F(2,84) = 3.50$. MSe = 150.07. This

shows up as a rather unusual pattern in the summaries of the college students, which can be seen in in Figure 2. In comparison with the other age groups, their summaries of the Poor Macro/Good Micro texts contained a large number of elaborations - a difference which was significant in post hoc testing - yet surprisingly few in the Poor Macro/Poor Micro condition. Interestingly, this pattern occurred again in the analysis of reorderings, discussed below.

See Figure 2

Reorderings. Both the main effects of group and macrostructure were significant on this measure: $F(2,84) = 10.54$, MSe = 18.26 and $F(1,84) = 18.86$, MSe = 32.67 for the two varialbes, respectively. There were more reorderings of the poorly organized texts ($\bar{X} = 2.36$) than of the well organized texts ($\bar{X} = 1.19$): As with number of generalizations, there was a significant Group x Macrostructure interaction in this inference type, $F(2,84) = 7.80$, MSe = 13.51. Post hoc testing revealed that the differences between age groups were not significant in the Good Macro condition, but in the Poor Macro condition the two older age groups reordered the information in their summaries significantly more than the youngest subjects. These results are shown in Figure 1.

A significant interaction of Group x Macrostructure x Microstructure was also observed in this analysis, which is quite similar to the three-way interaction found in the elaborations results: $F(2,84) = 7.76$, MSe = 13.45. These two patterns are

compared in Figure 2. As was the case for elaborations, both high school and college students reordered their summaries in the Poor Macro/Good Micro condition more than the 6th graders. However, the oldest students did much less reordering for texts in which both the macrostructure and the microstructure were poor, significantly less than the 10th grade students in this condition. This difference was supported by post hoc testing.

Connectives. Since there was considerable variability in the length of individual summaries, even within age groups, the analysis was performed on the percent connectives out of the total number of propositions. The analysis yielded significant main effects for Group and Micro, $F(2,84) = 3.39$, MSe = 4.05 and $F(1,84) = 9.11$, MSe = 10.90, respectively. In general, the summaries of the youngest subjects contained proportionately fewer connectives than those of the other two groups. Fewer connectives were produced overall for texts with the poor microstructure than for those with good microstructure, $\bar{X} = 6.61\%$ vs. $\bar{X} = 8.74\%$, respectively.

However, the percentages were distributed differently across the three age groups and text conditions, which can be seen in Figure 3. The interaction of Group x Microstructure was significant: $F(2,84) = 4.32$, MSe = 5.17. A general increase in percentage of connectives with age is evident only in the Poor Micro condition, though not all of the differences were significant on post hoc analysis. The 6th graders' summaries contained few connectives in either condition. Interestingly, it is the 10th graders who supplied the highest percentage of connectives in the

Good Micro condition - 11.10% on the average, but this drops sharply to 5.97% in the Poor Micro condition. This difference was significant on post hoc testing. The summaries of the college students, in contrast, contained about the same percentage of connectives regardless of the input text.

See Figure 3

Level in the Macrostructure

The percentage of statements from the summaries and probe question responses at each level of the macrostructure was analyzed by means of a 4 (Level) x 3 (Group) x 2 (Macrostructure) x 2 (Microstructure) multivariate analysis of variance. Level in the macrostructure was a within-subjects variable and Group, Macrostructure, and Microstructure were between-subjects variables. The percentage scores are based on the total number possible at each level. The analyses were performed on arcsine transformations of the proportions, however untransformed means are reported below.

After testing for between subjects effects, a series of planned comparisons was performed to examine in more detail differences in the proportions at each level as a function of age group and text condition. The three contrasts, which were chosen on the basis of theoretical interest, tested differences between the following pairs: (1) between topic level macropropositions (Level 1) and the other two levels of macropropositions (Levels 2 and 3), (2) between Level 2 and Level 3 macropropositions, and (3)

between macropropositions (Levels 1, 2, and 3) and details (Level 4).

Summaries. The main effect of Group was significant: $F(2,84) = 29.29$ MSe = 3.88. The older subjects included a larger percentage of text-based information from all levels in their summaries than the youngest subjects. The respective means for Grades 6, 10, and College are 27.51%, 45.37% and 50.35%. None of the other between subjects effects or interactions reached significance.

Level was a significant main effect in the within subjects analysis: $F(3,252) = 147.87$, MSe = 15.53. The preplanned contrasts between levels revealed two significant differences. One was between Level 1 topic statements and the other macropropositions (Levels 2 and 3): $F(1,84) = 275.56$). The other significant contrast was between the three macroproposition levels (Levels 1, 2, and 3) and the details (Level 4): $F(1,84) = 5.65$. As shown in Figure 4, subjects generally provided a lot of topic information, but relatively few of the macropropositions at Level 2 and Level 3 of the macrostructure. Nevertheless, there were proportionately more macropropositions than details in the summaries.

See Figure 4

The effect of level interacted significantly with age group: $F(6, 252) = 10.93$, MSe = 1.15. This showed up on two of the three contrasts. Overall there was little variation in the amount of detailed information (Level 4) included in the summaries by the three age groups, yet the amount of macro-information (Levels 1,

2, and 3) increased substantially as a function of age: $F(2,84) = 14.28$. This pattern can be seen in Figure 5. A sharper picture emerges when the scores are considered in terms of what proportion of the total text-based statements were at the detail level. Dividing the Level 4 means of each age group by the summed means of all four levels reveals that 39% of the text material in 6th grade summaries was at the detail level, compared with 23% in 10th grade and 20% in college student summaries. Thus we see a tendency for the proportion of detail in the summaries to decrease as the proportion of macropropositions increases with age.

See Figure 5

The contrast of Level 1 topic statements vs. Level 2 and Level 3 macropropositions was also significant: $F(2,84) = 12.08$. In terms of proportions, 70% of all the text based macropropositions provided by the 6th grade students were at the topic level. In contrast, the summaries of older subjects contained macropropositions at all three levels, which decreased the proportion of topic information to 62% in 10th grade and 58% in college student summaries.

The percentage of text-derived statements produced at each level was affected by the macrostructure of the text that was summarized. An interesting triple interaction of Group x Macro x Level occurred for the contrast between macropropositions (Levels 1, 2, and 3) and details (Level 4): $F = 3.12$. Figure 6 shows the percentage of macropropositions and details as a function of age

group and macrostructure of the input text. For the Good Macro texts the expected increase with age in the amount of macro-relevant information is evident. However, the poorly organized texts appear to have differentially affected the three age groups. The amount of detailed information increased in 6th grade summaries of these texts, while macropropositions decreased considerably. In contrast, the opposite trend was evident in the college student summaries. The percentage of macropropositional statements remained about the same in the summaries written by 10th graders. The similarity of this pattern to the significant Group x Macro interaction observed in the analysis of generalization inferences should be noted. It strongly supports the notion that the oldest subject group attempted to deal with the poorly structured input by reformulating the information at a higher level of generality.

See Figure 6

Probe Question Responses. Given the open-ended nature of the probed recall task, and the oral response mode, it is not surprising that there was considerable variability in the replies, both quantitatively and qualitatively. In particular, there were many statements, often generalizations, which had no counterpart in the author's macrostructure and were therefore omitted from the macrostructure levels analysis.

The between subjects effect of age group was highly significant: $F(2,84) = 32.00$, $MSe = 3.22$. With increasing age, sub-

jects' responses contained more information from the text at each level of the macrostructure, as was the case with their summaries. The mean percentages of text-based statements for 6th grade, 10th grade and college students are 26.14%, 43.06% and 45.77%, respectively.

The effect of Level was also significant in the within subjects analysis: $F(3,252) = 130.34$, $MSe = 15.35$, as were all three contrasts involving Level as a main effect. The values of F with (1,84) for each contrast are the following: 109.01 for Level 1 vs. Level 2 and Level 3 macropropositions; 65.35 for the contrast of Level 2 vs. Level 3 macropropositions; and 485.29 for the contrast of Level 1, 2, and 3 vs. Level 4. Thus, the percentage of responses decreased across the four levels of the macrostructure in this task, which is a rather different pattern of responses than was observed in the summarization results. This comparison is shown in Figure 4, which also reveals that subjects provided relatively fewer detailed statements overall in responding to the questions.

A second order Group x Level interaction was significant as well: $F(6,252) = 6.13$, $MSe = .72$. The locus of the interaction was in two of the contrasts: the test of macropropositions vs. details (Levels 1, 2, and 3 vs. Level 4): $F(2,84) = 25.18$ and the test of Level 1 vs. Level 2 and Level 3 macropropositions: $F(2,84) = 5.35$. The responses of college and high school students contained more text-based macropropositions than those of the 6th grade students on the average ($\bar{X} = 55.88\%$ for college students, $\bar{X} = 54.06\%$ for high school students vs. $\bar{X} = 31.56\%$ for the 6th graders).

If we again convert these percentages into proportions of (i.e., by dividing the summed means of Levels 1, 2, and 3 by the total of all four levels), the result is rather a surprise. The proportion of macrorelevant material in the 6th graders' responses nearly reaches that of the older students: 91% macropropositions vs. 94% for Grade 10 and 92% for college. Thus, although age differences are evident in the scores based on the percentage of total possible statements at each level, the overall proportion of macro-information is quite high across all three age groups in the probed recall task. This pattern of results contrasts sharply with that observed in the summarization task, in which the age differences were much greater: 6th grade summaries contained only 62% macropropositions, compared to 77% and 80% for the high school and college students, respectively. This comparison is shown in Figure 7.

See Figure 7

Also unlike the summaries, the probe question results revealed no significant interaction with macrostructure. Apparently the quality of the input text made little difference in subjects' ability to generate text-based macropropositions when directly probed for them.

Though developmental differences in familiarity with foreign countries undoubtedly existed (cf. Ohlhausen & Roller, 1988), they probably affected the results in a rather general manner: Most of the subjects who answered affirmatively to questions about their

knowledge of the countries discussed in the text were in the youngest age group and had recently completed a social studies unit on some of these countries (13 elementary school students vs. 6 high school and 3 college students). Most subjects, as anticipated, had a rather vague, global knowledge of the topics they had read about.

Discussion and Conclusions

A number of studies have pointed to qualitative differences in the way experienced and less experienced readers comprehend and use the information in expository materials. The present results support the conclusion that upper elementary school students do not succeed in understanding school type texts at a macrolevel. Instead, their summaries show evidence of comprehension processes that operate largely on local level meanings. In the present study the developmental differences in summarization were characterized in terms of the inferential processes that produced the summary and of the conceptual understanding of the text content that had been achieved. Specifically, an attempt was made to demonstrate how text features that promote or interfere with comprehension interact with age differences and task conditions in influencing the kind of mental representation that is constructed during reading and the way the information is expressed in a summary.

Summary of the Results

Age Group. Significant differences due to age were found on almost all of the measures investigated here. The younger students typically did not try to reduce the text information by generalizing it: 6th graders produced considerably fewer generalizations

than 10th graders, who in turn generated fewer than the college students. Instead, their summaries consisted largely of information selected from the original text. This agrees with Brown and Day's (1983) finding that the predominate strategy used by upper elementary school students in summarizing expository texts is based on selection and deletion operations.

Similarly, the 6th graders were more likely to follow the order of information in the original text than the older students. Younger students also did not elaborate what they had read as much, nor did they supply as many bridging inferences, in the form of explicit connectives. Thus, overall, the results point to a developmental trend in the amount of constructive processing that went into the summaries.

The results of the macrostructure levels analysis confirmed some of the observations obtained on the analysis of inferences. Most notably, the level at which information in the summaries was represented in the author's macrostructure revealed a similar pattern to that observed in the amount of generalization inferences. Thus, despite differences in the unit of measurement, the proportion of details, or actual text propositions, decreased as the proportion of macropropositions, or generalizations, increased with age.

Comparisons within the three levels of macropropositions also revealed significant age differences: Most of the macropropositions in the 6th grade summaries were topic statements - indeed 70% of the macropropositions were at Level 1 - but there were very few Level 2 or Level 3 macropropositions. Apparently even the

youngest subjects were able to select one or more topic statements to include in their summaries, but otherwise their summaries consisted largely of Level 4 details. Furthermore, of the three possible statements at Level 1, the younger students typically chose only the topic label (e.g., *It's about Peru and Argentina*), while older students usually provided the elaborated topic statements as well. Macropropositions at all three levels were prevalent in the summaries of the high school and college students. Thus, the proportions of both topic and detail information in the summaries declined as the ability to form other macropropositions (Level 2 and Level 3) increased with age.

This result, then, provides evidence that the mental representations of the meaning constructed by younger vs. older, more experienced readers are indeed quite different, as Scardamalia and Bereiter have suggested (1984). From the summaries of the youngest students one can infer a macrostructure composed of a simple topic statement and an assortment of details from the text. Though other macropropositions may be included, they are generally not well integrated into the overall meaning. With age, however, there was an increasing tendency to differentiate several levels of importance in the structure of the information. This conclusion is consistent with studies of sentence rating by children and adults (Brown & Smiley, 1977) and by good and poor readers (Winograd, 1984), and also with a recent study of on-line comprehension processing: Apparently school-age children do respond to the topic information in expository text, in a manner comparable to adults (Lorch, Lorch, Gretter, & Horn, 1987). However, the memory repre-

sentation that they construct is not a well integrated, hierarchical structure that would provide an effective retrieval path in tasks where the information must be directly accessed.

Group x Macrostructure. Poorly organized texts were dealt with differently by the three age groups, which showed up on both the inference and the macrostructure analyses. In the poor macrostructure condition, college students produced more generalizations and reorderings in an apparent effort to compensate for the disorganized input. In contrast, the quality of the input text had little effect on the amount of generalized information in the high school summaries, however the number of elaborations increased in this condition, which may have been a fallback strategy for them. (As in test taking, if one isn't sure just what to say, one tries to invent something!) The high school students did attempt to reorder the information in poorly organized texts a great deal more than the younger students, who simply followed the text order regardless and formed even fewer generalizations than in the other text conditions.

Texts with a poor macrostructure also affected the way textual information was distributed in the summaries. Although this trend was not significant in the number of text propositions, it reached significance in the macrostructure analysis. More specifically, the analysis revealed an increase in the proportion of macropropositions (Levels 1, 2, and 3) included in the summaries of college students who had read the poorly structured texts, with a corresponding decrease in the proportion of detail (Level 4). The opposite trend was observed for the youngest group of sub-

jects. That is, the poor macrostructure seems to have interfered with the 6th graders' ability to infer or select text based macropropositions.

Group x Microstructure. Increasing the difficulty of the microstructure caused a very complex pattern of results. First of all, the percentage of connectives remained at the same level in college student summaries for the texts with both good and poor microstructure. Slightly fewer connectives were provided by the 6th graders in the Poor Micro condition, but the percentage of connectives in their summaries was at a minimal level for all text versions. The largest effect was observed among the high school students: Although they readily used connectives if the original text contained them, they were not very successful at supplying them on their own, unlike the older students, who simply generated them as needed. In fact, the percentage of connectives in the high school summaries directly reflected their level of occurrence in the Good and Poor Micro texts: 11% vs. 5%, repectively.

Group x Macrostructure x Microstructure. A second effect of the texts with poor microstructure was evident in the three-way interactions, obtained on two of the measures: the number of elaborations and the number of reorderings. College students who had summarized a text with both a poor macrostructure and a poor microstructure supplied fewer of these inferences than in the other conditions, indeed, considerably fewer than the high school students.

Probe Question Responses. The probe question data pose an interesting contrast to the summaries. Although Level 1 topic

statements accounted for most of the information under both task conditions, the distribution of text material across the other levels was quite different. Figure 4 shows that many more of the inferred macropropositions (Level 2) were provided in response to the probe questions than in the summaries ($\bar{X}$ = 49.69% vs. $\bar{X}$ = 21.50%), but somewhat fewer of the Level 3 macropropositions ($\bar{X}$ = 19.55% vs. $\bar{X}$ = 25.14%). Furthermore, the details from Level 4 were greatly de-emphasized in the former task ($\bar{X}$ = 11.78% for the questions vs. $\bar{X}$ = 41.99% for the summaries). Thus, a more typical levels effect was observed in the probed recall task than in the summaries.

The typical age effect was present here as well: Older subjects provided more textual material in their responses than younger subjects. Furthermore, all subjects provided proportionately more macro-information in the probe condition, but the magnitude of the increase was especially large in the youngest subject group, as seen in Figure 7. Interestingly, good or poor macrostructure did not significantly affect the ability to produce macropropositions in the probe question task.

Theoretical Considerations

In general, the results of both the inference and the macrostructure analyses support the prediction of a gradual increase in macro-level processing with age. At the same time, difficulty at the macro- vs. microprocessing level affected the summaries of the three age groups in rather different ways. The theoretical model of discourse comprehension specified in van Dijk and W. Kintsch (1983) provides a framework for interpreting the rather complex

pattern of results obtained here.

In that theory discourse comprehension is described as an interactive cycle of text-driven and inferential operations. Various kinds of inferences are involved, each playing a somewhat different role in the process of meaning generation. Bridging inferences, such as connectives, are necessary to form a coherent representation of the textual meaning. Elaborations, reorderings, and generalizations are considered optional, interpretive inferences. However, these kinds of inferences result in more extensive and deeper memory traces and are especially important when the content must be recalled or used in some way. Despite their integrative function, elaborative inferences are less desirable when the reader's goal is to recall the gist of the content or to write a polished summary. For these tasks the ability to generalize the detailed information and to recombine and reformulate the ideas are essential operations because they are directly involved in deriving a macrostructure.

That adult readers do indeed make these distinctions in inference types was shown in studies by Graesser and Clark (1985a). Though elaborative statements were quite common in free recall protocols, they tended to drop out of summaries of connected prose texts, while the number of generalizations increased. If we examine the overall frequencies across the three age groups in the present study we see that the 6th grade summaries contain about the same number of generalizations and elaborations ($\bar{X}$ = 5.75 and $\bar{X}$ = 6.16, respectively). With age, however, the number of elaborations decreases as generalizations begin to play a greater

role ($\bar{X}$ = 18.78 generalizations vs. $\bar{X}$ = 10.06 elaborations in 10th grade summaries; $\bar{X}$ = 26.91 generalizations vs. $\bar{X}$ = 12.00 elaborations among the college students). This would suggest that the older students, and especially the college students, are distinguishing the relative importance played by these two inference types in summarizing, whereas the 6th graders seem to treat summarization much like a recall task.

This distinction between the two inference types was not maintained by the 10th graders for the texts that were badly organized. Instead, these subjects resorted to the more primitive strategy of elaborating more in the Poor Macro/Poor Micro condition, as shown in Figure 4. In contrast, the college students dealt with the poor quality of the input by eliminating elaborations, thus reducing the overall length of their summaries. Since their summaries for the texts with poor macrostructure also contained more generalizations, the content thereby became somewhat more concise and more generalized.[1] The similar pattern of responses observed in number of reorderings could be due to the fact that fewer elaborations resulted in shorter summaries and hence fewer opportunities to reorder the information. However, this result could also be interpreted in terms of the cognitive demands of different inference types.

Capacity Limitations and Inferences. A number of studies of adults' processing of textual materials suggests that the occurrence of inferences is highly constrained by the capacity of the working memory buffer (e.g., van Dijk & Kintsch, W. 1983; Graesser & Clark, 1985b; Kintsch, W., & Vipond, 1979; Singer, 1988). At the

same time, inferences differ in the amount of conscious effort required. For a skilled reader coherence building inferences are generated quite automatically (e.g., Graesser & Clark, 1985b; Just & Carpenter, 1980; Singer, 1988) whereas meaning construction inferences - those that generalize, reformulate, and extend the meaning on the basis of the reader's personal knowledge - are more consciously controlled, and thus are costly in terms of processing space.

In the present work the number of inferences in all categories was found to increase with age, which suggests that resource limitations interfered with the younger students ability to generate inferences. According to Perfetti (1985), an important aspect of developing skill in reading comprehension is the increased efficiency of lower-level verbal processes, which frees up memory capacity for more conscious, inferential processing. A number of studies have shown that younger students and those with poor comprehension skills are less likely to engage in spontaneous inferencing as they read (e.g., Bransford, Stein, & Vye, 1982; Oakhill, 1984; Paris, 1978; Weaver & Dickinson, 1982), which also supports this interpretation of the results obtained here. Even though decoding and accessing the lexical meaning were unproblematic for the 6th graders, these processes may have been less automatic for them than for the older students. Furthermore, the lack of connectives in the 6th grade summaries, and in the Poor Microstructure summaries of 10th grade students, suggests that middle-level coherence building inferences may still have required some conscious effort. Hence insufficient processing

resources may have affected the ability of these students to construct higher-level meanings or other inferences.

Increased processing load may also explain the decrease in elaborations, and possibly in reorderings as well, in college student summaries of the texts with poor macro- and poor microstructure. That is, in attempting to deal with the poorly written texts, the older students apparently concentrated their efforts on generating the appropriate kinds of inferences - generalizations and connectives. In contrast, the high school students reordered, but also elaborated more, while the youngest students simply produced fewer inferences. Generalizations, however, are more effortful than the other inference types. Hence the college students may have compensated for the extra processing costs by producing fewer elaborations and reorderings.

Skilled reading implies not only having available a repertoire of comprehension strategies, but also the ability to direct attention to different aspects of meaning construction as needed. What is clearly evident in the different patterns of inferences observed here is that elementary school students are limited both in their inferential processing of grade-level, expository materials, especially at the macro-level, and in their control of their own processing.

The Importance of Macrostructures in Comprehension. The surface oriented strategies of the younger students in this study are reflected not only in the small numbers of constructive inferences in their summaries, but also in a shallow interpretation of the meaning in terms of a global topic and assorted details.

With increasing age and experience, students' summaries reveal a hierarchical organization that that more closely resembles the author's macrostructure.

Although there were significant age differences in the probed recall task, the patterns did not parallel the results of the summary analyses. Most notably, the proportion of macropropositional material greatly increased, especially in the responses of the younger subjects. Furthermore, the organization of the input text did not affect the responses.

This result is not surprising when one considers the nature of the two tasks. Summarization, like recall, depends on having information well organized in memory. In fact, this is a major differentiator between such tasks and those involving cued recall and recognition memory, as Tulving (1983) has convincingly argued. There is considerable evidence that a macrostructure representation of the meaning plays an important role in facilitating the retrieval of information from memory. This structural framework apparently affects the quality of summaries as well. Even when the text is available to refer to during writing, as was the case here, it is important to have a sense of what the important points are and how they are related in order to make judgments about what to include. However, the three age groups who participated in this experiment differed in their ability to generate a hierarchically organized structure for the information in the texts. On the other hand, the 6th graders apparently had the information available in memory and were able to respond appropriately when directly probed for it. For this task a well

organized representation of the content is not as crucial because the questions themselves function as recall cues. Therefore the fact that the younger students were more successful in generating macropropositions when answering the questions than in summarizing can largely be explained by the different memory demands of the two tasks.

This study does not provide a direct test of the hypothesis that variable processing resources are largely responsible for the developmental patterns observed here. However, the results are compatible with this interpretation, which also agrees with the existing literature on inferential processing in reading comprehension tasks by adults and children. Other factors undoubtedly influence the ability to form macropropositions as well as other inferences. Indeed, the role of differences in general knowledge background, of experience with the structures of expository prose, in topic familiarity (e.g., Ohlhausen & Roller, 1988; Spilich, Vesonder, Chiesi, & Voss, 1979), in cognitive differences in the ability to deal with abstractions (e.g., Fischer, 1980) have not been adequately acknowledged here. All of these factors contribute to the development of efficient information processing by making it easier for the comprehender to chunk incoming information into macropropositions.

Macropropositions free up memory capacity by providing superordinate concepts to which individual propositions can be related as they are encountered in the text. Macroprocessing strategies, though they are more effortful, result in a well organized memory representation, which can serve as the framework for further

operations. In contrast, when one attends primarily to local-level meanings, each incoming proposition is related only to immediately preceding ones, and the resulting memory structure tends to be more fragmentary and less well integrated. The present study suggests that a complex relationship between processing load and the generation of higher-level inferences underlies the development of efficient text-processing strategies.

Educational Implications

A particularly interesting finding here was that the college students increased their level of constructive processing when comprehension was made more difficult, producing more generalized statements in their summaries than otherwise. In contrast, the youngest age group showed a tendency to fall back to lower-level strategies, producing fewer inference and a larger proportion of text details in their summaries of the disorganized texts. It would seem that for students with sufficiently developed text processing skills, the disorganized texts provided a challenge to put forth more constructive effort than the easy texts, whereas comprehension difficulty apparently had the opposite effect on students with less efficient skills. Some related findings have been reported recently by McDonald (1987) and Mannes and W. Kintsch (1987) which lend support to the above conclusion. In these two studies an advance organizer (outline or text) that was inconsistent with the structure or information of a text presented later benefitted college students' performance on inferential questions, though their summaries of the content did not follow the hierarchical organization of the input text. How are such

results to be interpreted in light of recent endeavors to teach school age children higher level macroprocessing strategies, such as deriving the main ideas in a text (e.g., Baumann, 1984; Hare & Borchardt, 1984)?

Although the results obtained here seem to support, once again, the argument that elementary and secondary students' macroprocessing would be enhanced by more readable school texts, there is another aspect to this issue which should also be considered. Namely, that educators need clearer definitions of the goals of instruction in terms of how a particular content is to be used. If the purpose is to assimilate a body of organized facts to be reproduced on an exam, then a memory representation that reflects the structure of the learning material is certainly desirable, and materials and instructional methods that make it easier to derive the underlying text macrostructure are clearly called for. However, if students are expected to apply the content to novel situations, to abstract generalizations, and to make judgments that require inferential understanding, then creating a structure of one's own or restructuring the to-be-learned material would result in a memory representation that is more richly integrated into the personal knowledge base, and hence more adaptable to different situations. The challenge for future research and educators alike is twofold: One goal is to provide children with the processing tools that enable a reader to abstract generalized meanings and the important information from a text, even in nonoptimal reading situations. Yet in addition, we need to know more about the conditions that enable constructive learning to take

place for students who are at various levels in the development of expertise.

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APPENDIX A

Examples of Texts

Peru and Argentina, Good Macro/Good Micro

Many factors influence whether a developing country can look forward to a prosperous future, or whether it will be forever doomed to backwardness and poverty. A comparison between Peru and Argentina illustrates this point.

The lofty, snowcapped peaks of the Andes mountains cover most of Peru. Even the valleys are so high that the air is thin and cold. Where the mountains reach down to the Pacific Ocean, it never rains, and the air is so dry that even wooden tools and cloth made hundreds of years ago are perfectly preserved in the sand.

In contrast, the heartland of Argentina consists of a huge, grassy plain, called the Pampas, where cowboys herd cattle on ranches as large as those in Texas. Where rivers flow into the Atlantic, the capitol city sprawls, with stately buildings and broad avenues, almost like in Paris.

Wheat fields cover much of the Pampas, whose soil is so rich that it never needs fertilizing. However, Argentina, like America, has trouble finding buyers for all the wheat and beef it produces. The country has almost no coal, iron or other minerals. Thus it cannot manufacture many things that people need, such as cars, machinery, and clothing, so these items must be imported from other countries.

Peru is very different. There are many small farmers who grow just enough corn to feed their families. Other people work on large plantations where coffee, cotton, and sugar cane is produced for export to other countries. The mountains have rich deposits of copper, silver, and lead, and the government has developed some very profitable mines. The Indians who live in the high mountain valleys raise sheep and llamas. The women weave beautiful sweaters and blankets from the wool of the llamas, just as their ancestors did. These weavings eventually find their way to the fashionable boutiques of Europe and the U.S. where they bring high prices.

Most Peruvians are Indians, descendants of the once proud and mighty Incas. When the Spanish destroyed the Inca empire, the Indians became the poor and oppressed people in their own land. A small group of white plantation owners has ruled the country ever since. They brought with them Christianity and the Spanish language, but the great Indian masses remained outside the Spanish culture. Most of them do not even speak Spanish, and few can read or write.

In Argentina, on the other hand, there are very few Indians today. The streets in the big cities are crowded with busy, energetic people, and in the outdoor cafes lively discussions can be heard. In recent years, the newspapers and magazines have been free to publish everything, for the people were finally able establish a free, democratic government.

Thus Peru and Argentina may develop very differently in the future.

Peru and Argentina, Good Macro/Poor Micro

Many factors influence whether a developing country can look forward to a prosperous future, or whether it will be forever doomed to backwardness and poverty. A comparison between Peru and Argentina illustrates this point.

The towering, snow-encrusted peaks of the Andes mountains extend over most of Peru. At this altitude, even the valleys are cold, and the air is thin. Where the mountains thrust downward to the Pacific, there is no moisture in the air, and wood implements, and even cloth, made hundreds of years ago, are perfectly preserved in the sand.

The Pampas is the Argentinian heartland, a huge, grassy plain where cowboys herd cattle on vast, Texas-style ranches. On a river estuary on the Atlantic Ocean the capitol city sprawls, with stately buildings and broad avenues that rival those of Paris.

Wheat fields cover much of the Pampas. The alluvial soil is so rich that fertilization is unnecessary. Argentina, like America, produces more wheat and beef than it can consume or even market abroad. The country is not blessed with deposits of coal, iron, or other minerals. Large-scale manufacturing of goods needed by the population is impossible. They must depend on other countries for imports of automobiles, machinery, and clothing.

Many Peruvians are small farmers whose families manage to subsist on what they grow. Others are employed on large plantations, where coffee, cotton, and sugar cane is produced for export. The mountains are riddled with copper, silver, and lead

deposits. Extracting the ore has proven to be a profitable venture for the government. Sheep and llamas are raised by Indians who live on the high mountain plateaus. Luscious sweaters and blankets are created by the women from alpaca and wool on hand looms, just as their ancestors did. These garments eventually make their way to the fashionable boutiques of Europe and the U.S. where they command high prices.

The majority of Peruvians are Indians, descended from the once proud and mighty Incas. The Inca empire was destroyed by the Spanish conquerors, and the Indians became the impoverished and oppressed people in their own land. The country has been ruled by a small nucleus of white plantation owners ever since. Along with Christianity they tried to impose the Spanish language on the natives. The Indian masses have remained alienated from the Spanish culture. Most are unable to speak Spanish, and few have learned to read or write.

Only a small Indian minority lives in Argentina today. The bustling city streets are crowded with busy, energetic people. In the outdoor cafes lining the boulevards, animated discussions can be heard. In recent years it has been possible for newspapers and magazines to publish everything. The people finally succeeded in establishing a free, democratic government.

Thus Peru and Argentina may develop very differently in the future.

Peru and Argentina, Poor Macro Good Micro

Many factors influence whether a developing country can look forward to a prosperous future, or whether it will be forever doomed to poverty and backwardness. A comparison between Peru and Argentina illustrates this point.

Most Peruvians are Indians, descendants of the once proud and mighty Incas. Most of them do not even speak Spanish, and few can read or write. However, the Andes mountains have rich deposits of copper, silver, and lead, and the government has developed some very profitable mines.

The capitol city of Argentina sprawls where rivers flow into the Atlantic, with stately buildings and broad avenues, almost like in Paris. Unlike Peru, very few Indians live there today. Argentina, like America, has trouble finding buyers for all the wheat and beef it produces. The streets in the big cities are crowded with busy, energetic people, and in the outdoor cafes lively discussions can be heard.

The lofty, snowcapped peaks of the Andes mountains cover most of Peru. Even the valleys are so high that the air is thin and cold. The Indians are the poor and oppressed people in their own land. Since the Spanish destroyed the Inca empire, a small group of white plantation owners has ruled the country.

On the other hand, wheat fields cover much of the Argentinian heartland, called the Pampas. The soil is so rich that it never needs fertilizing. The Pampas consists of a huge, grassy plain, where cowboys herd cattle on ranches as large as those in Texas.

In recent years, the newspapers and magazines have been free to publish everything, for the people were finally able establish a free, democratic government. The country has almost no coal, iron or other minerals. Thus it cannot manufacture many things that people need, such as cars, machinery, and clothing, so these items must be imported from other countries.

In contrast, the Indians who live in the high mountain valleys of Peru raise sheep and llamas. The Spaniards brought with them Christianity and the Spanish language, but the great Indian masses remained outside the Spanish culture. The women weave beautiful sweaters and blankets from the wool of the llamas, just as their ancestors did. These weavings eventually find their way to the fashionable boutiques of Europe and the U.S. where they bring high prices.

Where the Andes Mountains reach down to the Pacific Ocean, it never rains, and the air is so dry that even wooden tools and cloth made hundreds of years ago are perfectly preserved in the sand. There are many small farmers who grow just enough corn to feed their families. In addition, many Peruvians work on large plantations where coffee, cotton, and sugar cane is produced for export to other countries.

Thus Peru and Argentina may develop very differently in the future.

Peru and Argentina, Poor Macro/Poor Micro

Many factors influence whether a developing country can look forward to a prosperous future, or whether it will be forever doomed to backwardness and poverty. A comparison between Peru and Argentina illustrates this point.

The majority of Peruvians are Indians, descended from the once proud and mighty Incas. Most are unable to speak Spanish, and few have learned to read or write. The Andes mountains are riddled with copper, silver, and lead deposits. Extracting the ore has proven to be a profitable venture for the government.

The capitol city of Argentina sprawls on a river estuary on the Atlantic Ocean, with stately buildings and broad avenues that rival those of Paris. Only a very small Indian minority lives there today. Argentina, like America, produces more wheat and beef than it can consume or even market abroad. The bustling city streets are crowded with busy, energetic people. In the outdoor cafes animated discussions can be heard.

The towering, snow-encrusted peaks of the Andes mountains extend over most of Peru. At this altitude, even the valleys are cold and the air is thin. The Indians are the impoverished and oppressed people in their own land. Since the Spanish conquerors destroyed the Inca empire, a small nucleus of white plantation owners has ruled the country.

Wheat fields cover much of the Argentinian heartland, called the Pampas. The alluvial soil is so rich that fertilization is unnecessary. The Pampas consists of a huge, grassy plain, where

cowboys herd cattle on vast, Texas-style ranches. In recent years it has been possible for newspapers and magazines to publish everything. The people finally succeeded in establishing a free, democratic government. The country is not blessed with deposits of coal, iron, or other minerals. Large-scale manufacturing of goods needed by the population is impossible. They must depend on other countries for imports of automobiles, machinery, and clothing.

Sheep and llamas are raised by Indians who live on the high mountain plateaus of Peru. Along with Christianity, the Spaniards tried to impose the Spanish language on the natives. The Indian masses have remained alienated from the Spanish culture. Luscious sweaters and blankets are created by the women from alpaca and wool on their hand looms, just as their ancestors did. The garments eventually make their way to the fashionable boutiques of Europe and the U.S. where they command high prices.

Where the Andes Mountains thrust downward to the Pacific Ocean, there is no moisture in the air, and even wooden implements and cloth, made hundreds of years ago, are perfectly preserved in the sand. Many Peruvians are small farmers whose families manage to subsist on what they grow. Others are employed on large plantations where coffee, cotton, and sugar cane is produced for export.

Thus Peru and Argentina may develop very differently in the future.

APPENDIX B

Table 1. Author's Macrostructure of Peru and Argentina text.

Level 1: Topic and Conclusion

1 - label (it s about Peru & Argentina)

2 - a comparison

3 - many factors influence their development/ how they're developing

Level 2: Inferred Subtopics

1 - geography

2 - economy

3 - society/culture

Level 3: Subheadings

Peru: 1 - land

2 - climate/vegetation

Arg: 3 - land

4 - capitol city

5 - farming

6 - natural resources

Peru: 7 - farming

8 - natural resources

9 - Indian's livelihood

10 - population

11 - government

12 - education

Arg: 13 - population

14 - education

15 - government

Level 4: Details

Peru: 1 - mountains

2 - valleys are cold

3 - thin air

4 - on the Pacific

5 - very dry

6 - things are preserved

Arg: 7 - large plains

8 - called the Pampas

9 - many cattle ranches

10 - rivers/Atlantic Ocean

11 - capitol has buildings/avenues like Paris

12 - fertile soil

13 - wheatfields

14 - a surplus of wheat and beef is produced

15 - no iron, coal, or minerals

16 - little manufacturing

17 - has to import goods

Peru: 18 - farmers grow corn

19 - enough to feed their families

20 - plantations produce coffee & sugar cane

21 - for export

22 - mountains have gold, silver, lead, minerals

23 - government mines for profit

24 - sheep & llamas

25 - in high valleys

26 - handwoven goods

27 - are sold abroad

28 - Indians, descendents of the Incas

29 - conquered by the Spanish

30 - Indians became poor & oppressed

31 - white plantation owners rule

32 - Spaniards brought Spanish & Christianity

33 - Indians don't speak Spanish/alienated

34 - Indians can't read

Arg: 35 - few Indians

36 - bustling cities/busy people

37 - free to publish

38 - democracy

Author Notes

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Footnotes

[1]It should be noted that the college students could hardly be regarded as expert writers. In fact, their summaries contained many examples of incorrect grammar and most were unnecessarily redundant and discursive in all conditions. However, in the Poor Macro condition the trend is at least encouraging!

Figure Headings

Figure 1. Number of generalizations and reorderings as a function of age group and macrostructure.

Figure 2. Number of elaborations and reorderings as a function of age group, macrostructure, and microstructure.

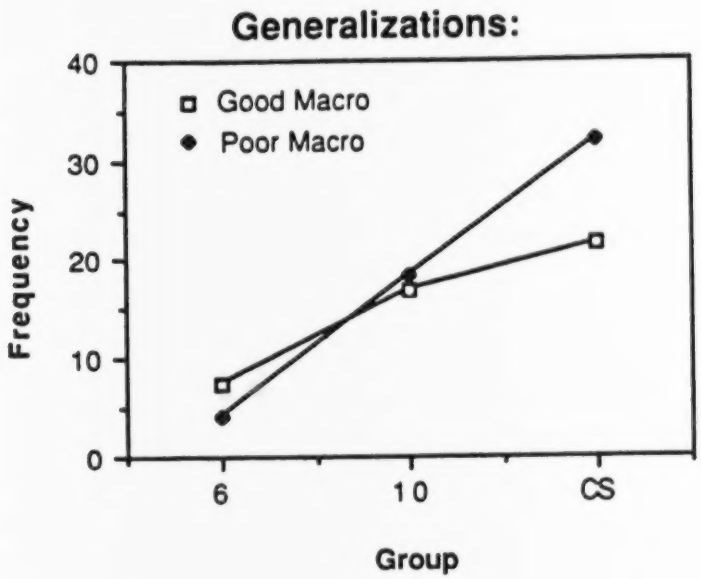
Figure 3. Percent connectives as a function of age group and microstructure.

Figure 4. Percent text-based statements at each level in the macrostructure in summaries and probe question responses.

Figure 5. Percent macropropositions and details in summaries as a function of age group.

Figure 6. Percent macropropositions and details in summaries as a function of age group and macrostructure.

Figure 7. Proportion of macropropositions in summaries and probe question responses as a function of age group.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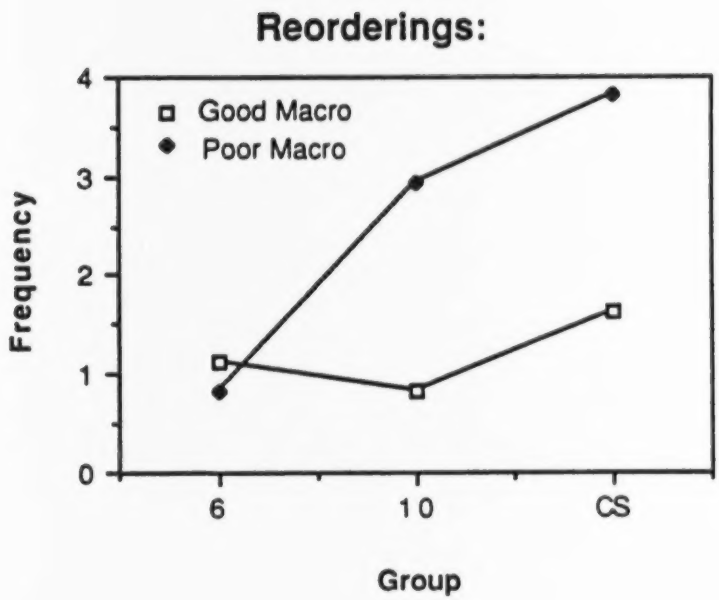
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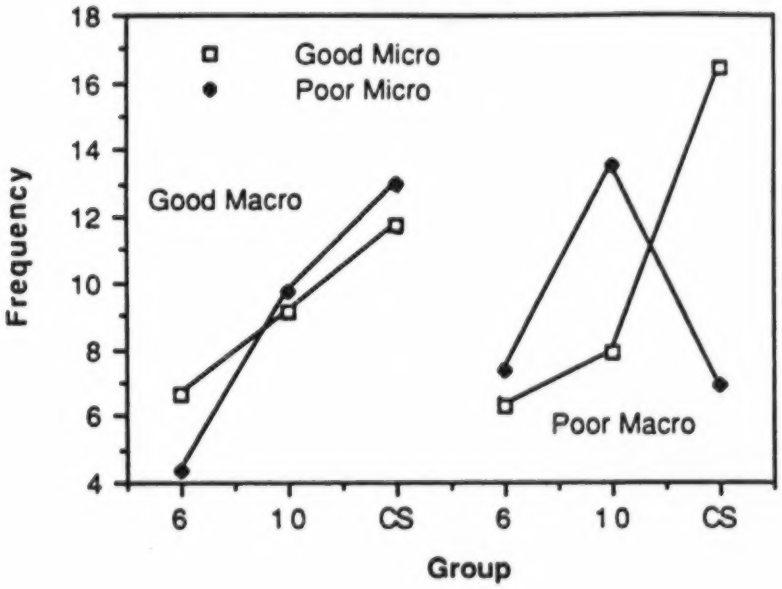
Elaborations:



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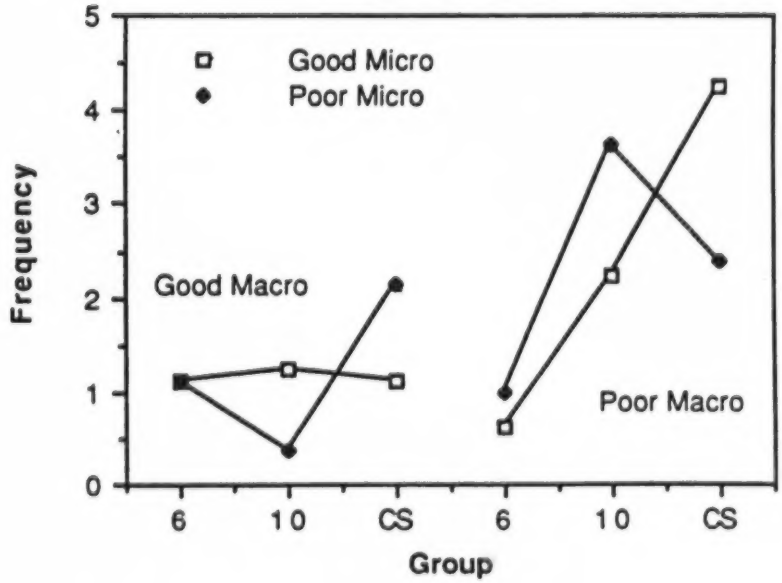

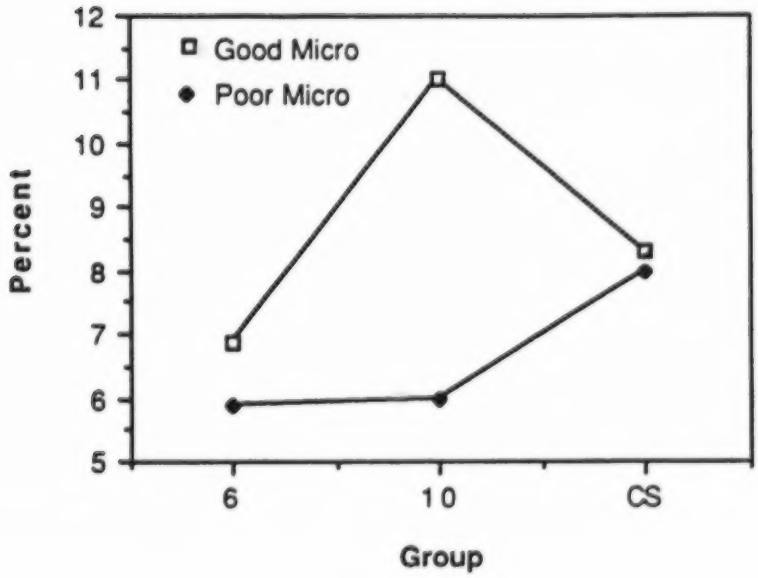
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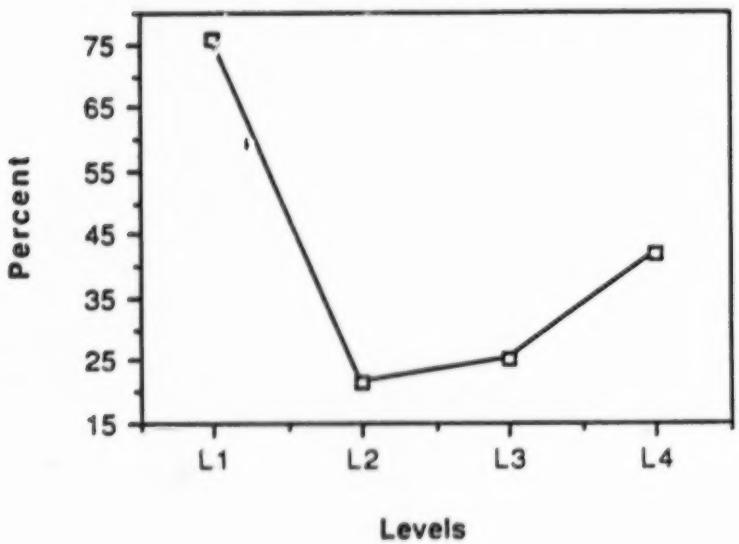

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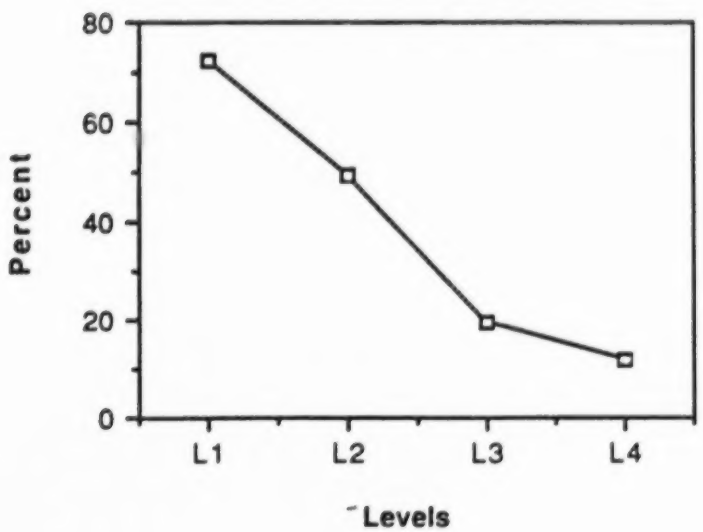

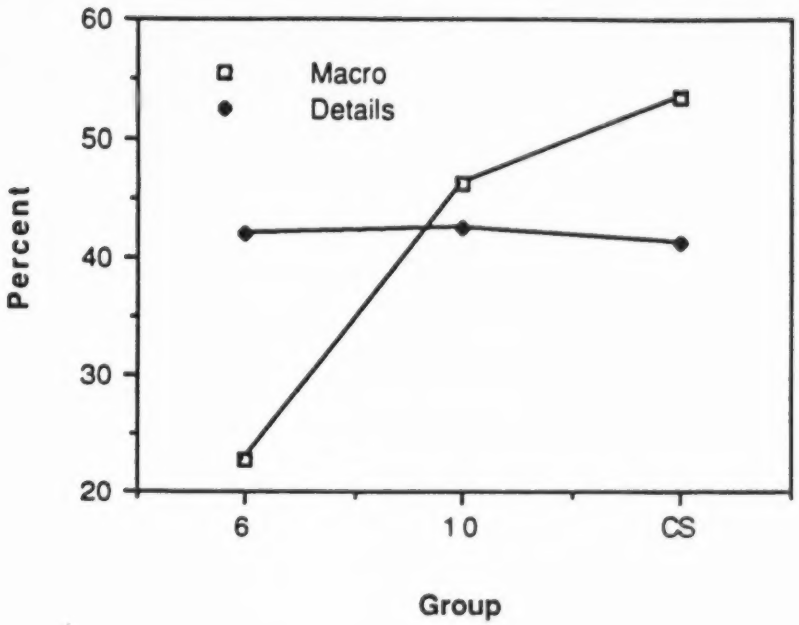
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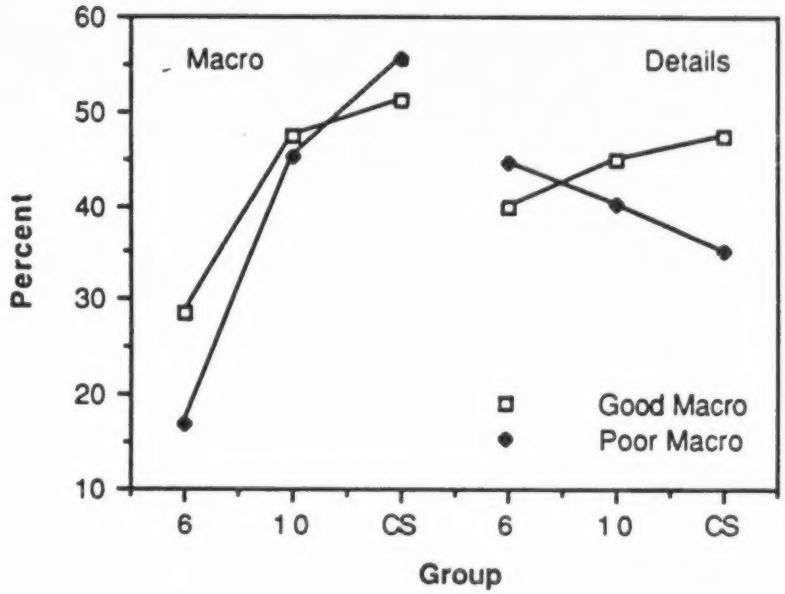
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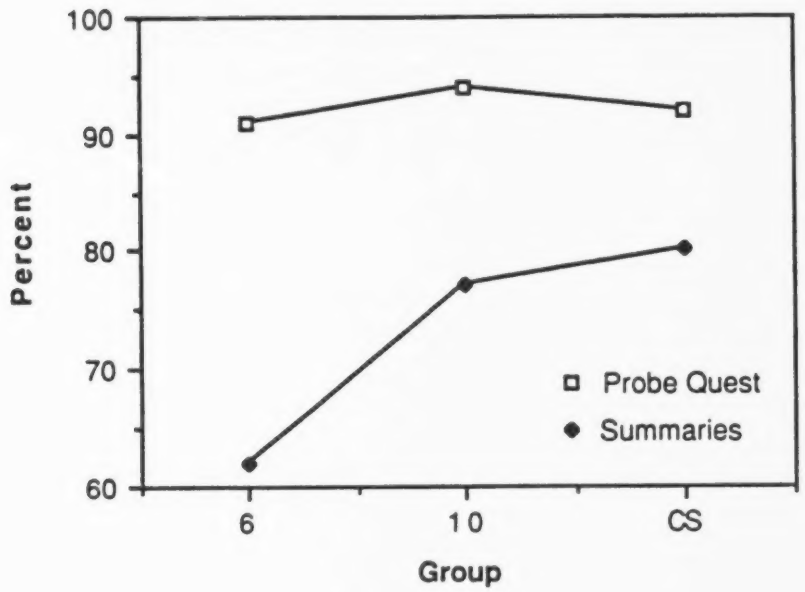
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